

Composting Facility (No.) 317

DEFINITION

This is a treatment component of an agricultural management system for the biological stabilization of organic material.

PURPOSES

To treat livestock, poultry, and organic waste material biologically to reduce the pollution potential of organic agricultural wastes to surface or groundwater.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:

- Organic waste material is generated by agricultural production or processing;
- A composting facility is a component of a planned Comprehensive Nutrient Management System; and
- A composting facility can be sited, constructed, operated, and maintained without polluting air and/or water resources.

CRITERIA

Laws and Regulations

The installation and operation of the composting facility shall comply with all federal, state, and local laws, rules, and regulations. Composting facilities will be in compliance with recommendations found in Generally Accepted Agricultural and Management Practices (GAAMPS) for Manure Management and Utilization, and for Site Selection and Odor Control for New and Expanding Livestock Production Facilities. Also refer to Bodies of Dead Animals, Act 239 of 1982 updated through PA 194 of 1999.

Safety

Safety and personal protection features and practices shall be incorporated into the facility and its operation, as appropriate, to minimize the occurrence

of equipment hazards and biological agents during the composting process.

Facility Siting

Field sites: To avoid contamination of groundwater with nitrates, the bottom elevation of the composting site shall be 2 feet above the seasonal high water table. In Michigan, this includes all Soil Management Groups (SMG) that are classified well-drained (a). These sites will never be located over field tile (subsurface drains). See the Michigan NRCS Conservation Fact Sheet Windrow Composting Manure (317-1) for planning and management considerations.

Permanent sites: The facility shall be installed on concrete slabs or other appropriate surfaces. Surface specifications can be determined using criteria found in Michigan NRCS Standard Heavy Use Area Protection (561). The design bottom elevation of the facility will be no lower than 2 feet above the seasonal high water table. For all SMGs classified somewhat poorly drained (b) or poorly drained (c), on-site investigations will be conducted to determine depth of seasonal water and whether artificial drainage would be required to remove or redirect water that may be flowing laterally.

Ideally, compost facilities should be located outside of floodplains. However, if site restrictions require location within a floodplain, they shall be protected from inundation or damage from a 25-year flood event, or larger.

Locate compost facilities so that prevailing winds and landscape elements such as building arrangement, landforms, and vegetation minimize odors and protect the visual resource.

Direct surface runoff away from the compost facility. Direct contaminated runoff from compost facilities to an appropriate storage or treatment facility such as a Filter Strip - Michigan NRCS Standard Animal Waste Management (780). Stored runoff will be applied to land, added to composting material for moisture control, or applied to grassed infiltration areas, as per the Comprehensive Nutrient Management Plan.

Compost Mix

The following design criteria are used to develop a compost mix that encourages aerobic microbial decomposition and avoids nuisance odors.

Carbon-Nitrogen Ratio:

The initial compost mix shall result in a carbon to nitrogen ratio between 25:1 and 40:1. Compost with a greater carbon to nitrogen ratio can be used if nitrogen immobilization is not a concern. Refer to National Engineering Handbook, Part 637, Environmental Engineering, Chapter 2, Composting (Section 637.0202, Design of Compost Mixtures) or NRAES-54, On-Farm Composting Handbook (Table 3.3, Formulas for Determining Compost Recipes and Table A.1, Typical Characteristics of Selected Raw Materials).

Carbon Source:

A dependable source of carbonaceous material with a high carbon to nitrogen ratio (C:N) shall be stored and available to mix with nitrogen-rich waste materials.

Bulking Materials:

Add bulking materials to the mix, as necessary, to enhance aeration.

The bulking material may be the carbonaceous material used in the mix or a non-biodegradable material that is salvaged at the end of the compost period. If a non-biodegradable material is used, provisions shall be made for its salvage.

Moisture Level:

Provisions must be made for maintaining adequate moisture in the compost mix throughout the compost period within the range of 40 to 65 percent (wet basis).

In high precipitation climatic regions, care shall be taken to prevent excess moisture from accumulating in the compost. Facility covers, such as a non-woven geotextile blanket or roofed structure, may be required to provide for a suitable product.

Temperature of Compost Mix:

Manage the compost to attain and then maintain the internal temperature for the time duration required to meet management goals.

When the management goal is to reduce pathogens, the compost shall attain a temperature greater than 140°F for at least 5 days, as an average, throughout the compost mass.

This temperature and time criterion may be achieved during either primary or secondary composting stages, or as the cumulative time of greater than 140°F in both stages.

Turning/Aeration:

The frequency of turning/aeration shall be appropriate for the composting method used, such as passive vs. actively managed windrow, and to attain the desired amount of moisture removal and temperature control while maintaining aerobic degradation.

Facility Type

Selection of the composting facility/method shall be based on the availability of raw material, the desired quality of final compost, equipment, labor, time, and land available.

Facility structural elements such as permanent bins, concrete slabs, and roofs shall meet the requirements of Michigan NRCS Standard Waste Storage Facility (313).

Facility Size

Size the compost facility to accommodate the amount of material planned for active composting plus space required for staging of original materials and curing of end product.

Dimensions selected for elements of the compost facility shall accommodate equipment used for mixing, loading, unloading, and aeration.

Sizing of facilities for composting dead animals shall be based on normal mortality loss records for the operation. Or, if not available, locally established mortality rates for the type of operation shall be used.

Compost Period

Continue the composting process long enough for the compost mix to reach the stability level where it can be safely stored without undesirable odors. It shall also possess the desired characteristics for its use such as lack of noxious odor, desired moisture content (less than 40 percent), desired C:N ratio (compared to original components, average between 13:1 and 18:1), and texture. The compost period shall involve primary and secondary composting (curing up to 30 days), as required, to achieve these characteristics.

Test the finished compost, as appropriate, to assure that the required stabilization has been reached.

Use of Finished Compost

Land application of finished compost shall be in accordance with Michigan NRCS Standard Nutrient Management (590) and based on results of a nutrient sample analysis.

CONSIDERATIONS

Develop an initial compost mix with a carbon to nitrogen ratio of at least 25:1 to reduce most offensive odors.

Minimize odors and nitrogen loss by selecting carbonaceous material that, when blended with the nitrogenous material; provides a balance of nutrients and porous texture for aeration.

Aligning windrows north to south can maximize solar warming.

Windrows on field sites should be constructed perpendicular to contours on slopes of 2 percent to 6 percent.

Protect compost facilities from the wind in cold climates. Wind protection may help prevent excess drying of the compost in dry climates.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use.

Support data documentation requirements are as follows:

- Inventory and evaluation records
 - CONS-6 notes or special report
- Survey notes, where applicable
 - Design survey
 - Construction layout survey
 - Construction check survey
- Design records
 - Physical data, functional requirements, and site constraints, where applicable
 - Soils/subsurface investigation report, where applicable
- Design and quantity calculations
- Construction drawings/specifications with:
 - Location map

- “Designed by” and “Checked by” names or initials
- Approval signature
- Job class designation
- Initials from pre-construction conference
- As-built notes
- Construction inspection records
 - CONS-6 notes or separate inspection records
 - Construction approval signature
- Record of any variances approved, where applicable
- Record of approvals of in-field changes affecting function and/or job class, where applicable

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan that is consistent with the purposes of this practice, and the life of the composting facility. Recipe ingredients and sequence that they are layered and mixed shall be given in the plan.

Safety requirements for operation of the composting facility shall be provided.

Manage the compost piles for temperature, odors, moisture, and oxygen, as appropriate. Make adjustments throughout the composting period to ensure proper composting processes.

Closely monitor temperatures above 140°F. Take action immediately to cool piles that have reached temperatures above 165°F.

When removing finished product from windrows where a mechanical turner was used, do not remove the non-composted base material. This material should be collected and incorporated into a subsequent windrow.

The operation and maintenance plan shall state that composting is a biological process. It requires a combination of art and science for success. Hence, the operation may need to undergo some trial and error in the start-up of a new composting facility.

REFERENCES

Northeast Regional Agricultural Engineering Publications

Rynk, R., 1992. On Farm Composting Handbook. NRAES-54, Northeast Regional Ag Engineering Service, 152 Riley Robb Hall, Cooperative Extension, Ithaca, NY 14853-5701, 186 pp.

MSU Extension Publications

Cavigelli, M.A., S.R Deming, L.K. Probyn, and R.R. Harwood (eds.), 1998. Michigan Field Crop Ecology: Managing Biological Processes for Productivity and Environmental Quality, Michigan State University-Extension Bulletin E-2646, 92 pp.

Lehnert, R. H., J.C. Durling and C.S. Lufkin (eds.), 2000. Composting on Michigan Farms, Michigan State University-Extension Bulletin E-2715. 27 pp.

Also

USDA-NRCS National Engineering Handbook, Part 637, Environmental Engineering, Chapter 2, Composting.

USDA-NRCS National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook, Chapter 10, part (f), pages 42-62 Composting.

Generally Accepted Agricultural and Management Practices for Manure Management and Utilization.

Generally Accepted Agricultural and Management Practices for Site Selection and Odor Control for New and Expanding Livestock Production Facilities.

Bodies of Dead Animals, Act 239 of 1982 updated through PA 194 of 1999.